Tetra Tech, Inc. DATA VALIDATION REPORT LEVEL II

Site:	West Lake Landfill S	Site, Bridgeton,	Missouri
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Data Reviewer: Harry Ellis, Tetra Tech, Inc. (Tetra Tech)

Review Date June 24, 2014

Sample Delivery Group (SDG): J6735

Laboratory:

Sample Numbers: WAA-01-AF-PS-20140515, WAA-02-AF-PS-20140515, WAA-03-AF-PS-20140515, WAA-04-AF-PS-20140515, WAA-05-AF-PS-

20140515, and WAA-00-AF-TB-20140515

TestAmerica Laboratories, Inc. (Earth City, Missouri)

Matrix / Number of Samples: 5 Air Samples and 1 Trip Blank

The data were qualified according to the U.S. Environmental Protection Agency (EPA) Region 7 documents entitled "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review" (9240.1-48), June 2008. In addition, the Tetra Tech document "Review of Data Packages from Subcontracted Laboratories" (February 2002) and the EPA and others document "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (July 2004) were used along with other criteria specified in the applicable methods.

The review was intended to identify problems and quality control (QC) deficiencies that were readily apparent from the summary data package. The following sections discuss any problems or deficiencies that were found, and data qualifications applied because of non-compliant QC. The data review was limited to the available field and laboratory QC information submitted with the project-specific data package.

I, Harry Ellis, certify that all data validation criteria outlined in the above-referenced documents were assessed, and any qualifications made to the data accorded with those documents.

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24 June 2014

Certified by Harry Ellis, Chemist

103I9025140058.000

Date

SDG J6735

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DATA VALIDATION QUALIFIERS

U — The analyte was not detected above the reported sample quantitation limit.
 J — The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
 UJ — The analyte was not detected above the reported sample quantitation limit, which is estimated.
 R — The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. Presence or absence of the analyte cannot be verified.

DATA ASSESSMENT

Sample delivery group (SDG) J6735 included five (5) environmental air (filter) samples and one (1) QC sample (a field blank). Samples were analyzed for total alpha-emitting radium by EPA SW-846 Method 9315 and for isotopic (alpha-emitting) thorium and radium by Department of Energy (DOE) Method A-01-R. The following summarizes the data validation that was performed.

RADIOANALYTICAL ANALYSES

I. Holding Time and Chain of Custody (COC) Requirements

The samples were received by the laboratory and analyzed within the established holding time of 6 months from sample collection to analysis. No data were qualified.

II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Insufficient sample was available for MS/MSD analyses. Duplicate LCS analysis provided adequate data on precision and accuracy. No qualifications were applied.

III. Blanks

The laboratory (method) blanks yielded low activities of one of the three thorium isotopes and two of the three uranium isotopes. The field blank yielded low activities for to thorium isotopes and two uranium isotopes. These blank activities were similar to those seen in the other field samples. No qualifications were applied.

IV. Laboratory Control Sample (LCS)

All percent recoveries and the relative percent differences from the duplicate LCS analyses were within established control limits. No qualifications were applied.

V. Surrogates

These radioanalytical methods use a "carrier" or "tracer", whose recovery serves the same functions as surrogate recoveries. All tracer recoveries from the thorium and uranium analyses were within the laboratory's QC limits. However four field samples (including the field blank) and the LCS (but not the laboratory blank and duplicate LCS) yielded slightly high recoveries for the barium carrier (111 to 119 percent, versus QC limits of 40 to 110 percent). The other samples yielded high, but acceptable results (105 to 110 percent recovery). These results appear to reflect a laboratory error, such as mis-spiking. No qualifications were applied.

VI. Comments

10319025140058.000

All detected results were less than their reporting limits ("RL"). These extrapolations should be qualified as estimated (flagged "J").

VII. Overall Assessment of Data

Overall data quality is acceptable, with no significant qualifications applied. All data are usable as qualified for their intended purposes. Data users should note the similar low activities in all samples, blank and other, which complicates interpretation.



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THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc. TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Tel: (314)298-8566

TestAmerica Job ID: 160-6735-1

Client Project/Site: West Lake Landfill - Filters

For:

Tetra Tech EM Inc. 415 Oak Street Kansas City, Missouri 64106

Attn: Ms. Emily Fisher

all .

Authorized for release by: 6/19/2014 4:46:40 PM

Erika Gish, Project Manager II (314)298-8566 erika.gish@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Client: Tetra Tech EM Inc. Project/Site: West Lake Landfill - Filters

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Case Narrative

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Job ID: 160-6735-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Tetra Tech EM Inc.

Project: West Lake Landfill - Filters

Report Number: 160-6735-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 5/19/2014 2:08 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 20.5° C.

Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate/sample duplicate (MS/MSD/DUP). The samples are filters that must be split between analysis. A LCS/LCSD was used instead.

RADIUM-226 (GFPC)

Samples WAA-01-AF-PS-20140515 (160-6735-1), WAA-02-AF-PS-20140515 (160-6735-2), WAA-03-AF-PS-20140515 (160-6735-3), WAA-04-AF-PS-20140515 (160-6735-4), WAA-05-AF-PS-20140515 (160-6735-5) and WAA-00-AF-FB-20140515 (160-6735-6) were analyzed for Radium-226 (GFPC) in accordance with SW846 9315. The samples were prepared on 05/23/2014 and analyzed on 06/17/2014.

The barium carrier recovery is just outside the upper control limit of 110% for the following samples: LCS 160-123713/2-A (113%), 160-6735-A-1-I (112%), 160-6735-A-2-G (111%), 160-6735-A-5F (119%), and 160-6735-A-6-F (113%). No abnormalities were observed

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estAmerica St. Louis 6/19/2014

Case Narrative

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Job ID: 160-6735-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

while these samples were being taken out of ingrowth. The laboratory control sample (LCS) spike recovery and RER value are within acceptance limits regardless of truncation. The samples have been truncated to 100% in order to minimize any potential bias a high carrier recovery may have on the results: (LCS 160-123713/2-A), (LCSD 160-123713/3-A), (MB 160-123713/1-A), WAA-00-AF-FB-20140515 (160-6735-6), WAA-01-AF-PS-20140515 (160-6735-1), WAA-02-AF-PS-20140515 (160-6735-2), WAA-03-AF-PS-20140515 (160-6735-3), WAA-04-AF-PS-20140515 (160-6735-4), WAA-05-AF-PS-20140515 (160-6735-5).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20140515 (160-6735-1), WAA-02-AF-PS-20140515 (160-6735-2), WAA-03-AF-PS-20140515 (160-6735-3), WAA-04-AF-PS-20140515 (160-6735-4), WAA-05-AF-PS-20140515 (160-6735-5) and WAA-00-AF-FB-20140515 (160-6735-6) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 05/30/2014 and analyzed on 06/03/2014.

The MB has Th-230 activity greater than the CRDL. The samples were re-extracted once for MB contamination and the sample results are comparable. There is insufficient sample to re-extract a second time. The sample activity is less than the CRDL. The data have been qualified and reported: (LCS 160-124653/2-A), (LCSD 160-124653/3-A), (MB 160-124653/1-A), WAA-00-AF-FB-20140515 (160-6735-1), WAA-01-AF-PS-20140515 (160-6735-1), WAA-02-AF-PS-20140515 (160-6735-2), WAA-03-AF-PS-20140515 (160-6735-3), WAA-04-AF-PS-20140515 (160-6735-4), WAA-05-AF-PS-20140515 (160-6735-5).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples WAA-01-AF-PS-20140515 (160-6735-1), WAA-02-AF-PS-20140515 (160-6735-2), WAA-03-AF-PS-20140515 (160-6735-3), WAA-04-AF-PS-20140515 (160-6735-4), WAA-05-AF-PS-20140515 (160-6735-5) and WAA-00-AF-FB-20140515 (160-6735-6) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with A-01-R. The samples were prepared on 05/23/2014 and analyzed on 05/28/2014.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

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>>> Select a Laboratory <<<

Chain of Custody Record

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Preservation Used: 1= Ice, 2= HCI; 3= H2SO4; 4=HNO3; 5	=NaOH; 6=	Other	不够完全							阿旗									验》						27/19/0
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Comments Section if the lab is to dispose of the sample.	List ally Li	A Waste O	odes for th	e sampi	e in tite	- 1																			
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6/19/2014

Westlake Landfill Weekly Air Filter Samples Collection Summary dates 5-8-14 to 5-15-14

	MCP :	#Filter Holder	Today market and the second	2.51 om	Rate End Time	2.56 cfm0	Total Time (mins)	STATE OF THE CONCUMENT	2.55%
			* 14 Th	1 7 7	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1				
2	PVA	2	15:14	2.51 cfm	16:23	2.70 cfm	10152	2.61	2649
	B PVFD	3	12:41	2.5 cfm	16:45	2.46 cfm	10326	2.48	2560
2	SV	4	13:21	2.5 cfm	17:12	2.66 cfm	10314	2.58	2661
ī	SSC	5	14:15	2.5 cfm	15:17	2.67 cfm	10146	2.58	2617
FB	NA	6	NA	NA	NA NA	NA	NA NA	NA	NA

•	
WAA-01-AF-PS-20140515	25586
WAA-02-AF-PS-20140515	26497
WAA-03-AF-PS-20140515	25608
WAA-04-AF-PS-20140515	26610
WAA-05-AF-PS-20140515	26177
WAA-00-AF-FB-20140515	na

Login Sample Receipt Checklist

Client: Tetra Tech EM Inc.

Job Number: 160-6735-1

List Source: TestAmerica St. Louis

Login Number: 6735 List Number: 1 Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is = background as measured by a survey meter.</td <td>True</td> <td></td>	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	



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Definitions/Glossary

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Qualifiers

Qualifier	Qualifier Description

U Result is less than the sample detection limit.

X Carrier exceeds control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
--------------	---

Listed under the "D" column to designate that the result is reported on a dry weight basis

Percent Recovery CFL Contains Free Liquid CNF Contains no Free Liquid

Duplicate error ratio (normalized absolute difference) DER

Dil Fac Dilution Factor

DL, RA, RE, IN Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample

Decision level concentration DLC Minimum detectable activity **Estimated Detection Limit EDL** Minimum detectable concentration MDC

MDL Method Detection Limit Minimum Level (Dioxin) ML NC Not Calculated

Not detected at the reporting limit (or MDL or EDL if shown) ND

Practical Quantitation Limit PQL

Quality Control QC RER Relative error ratio

RL Reporting Limit or Requested Limit (Radiochemistry)

RPD Relative Percent Difference, a measure of the relative difference between two points

Toxicity Equivalent Factor (Dioxin) TEF TEQ Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Method	Method Description	Protocol	Laboratory
9315	Radium-226 (GFPC)	SW846	TAL SL
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Page 9 of 19

Protocol References:

DOE = U.S. Department of Energy

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

















Sample Summary

Matrix

Filter

Filter

Filter

Filter

Filter

Filter

Client: Tetra Tech EM Inc.

Lab Sample ID

160-6735-1

160-6735-2

160-6735-3

160-6735-4

160-6735-5

160-6735-6

Project/Site: West Lake Landfill - Filters

Client Sample ID

WAA-01-AF-PS-20140515

WAA-02-AF-PS-20140515

WAA-03-AF-PS-20140515

WAA-04-AF-PS-20140515

WAA-05-AF-PS-20140515

WAA-00-AF-FB-20140515

TestAmerica Job ID: 160-6735-1

Received

05/19/14 14:08

05/19/14 14:08

05/19/14 14:08

05/19/14 14:08

05/19/14 14:08

05/19/14 14:08

Collected

05/15/14 12:22

05/15/14 16:23

05/15/14 16:45

05/15/14 17:12

05/15/14 15:17

05/15/14 18:05

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Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Lab Sample ID: 160-6735-1

Client Sample ID: WAA-01-AF-PS-20140515

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Date Collected: 05/15/14 12:22

Matrix: Filter

Date	Received:	05/19/14 14:08

-	Method: 9315 - Radiun	n-226 (GFF	C)								
				Count	Total						
				Uncert.	Uncert.						
	Analyte	Result	Qualifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	DII Fac
	Radium-226	0.319	3	0.188	0.190	1 00	0.256	pCi/Sample	05/23/14 14:06	06/17/14 11.31	1
	Carrier		Qualifier	Limits					Prepared	Analyzed	Dil Fac
	Ba Carrier	112	X	40 - 110					05/23/14 14.06	06/17/14 11 31	1

				Count	Total						
				Uncert.	Uncert.						
Analyte	Result	Qua	lifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.0570	Ū	u	0.0643	0.0644	Time	0.217	pCi/Sample	05/30/14 15:45	06/03/14 16:48	1
Thorium-230	0.637	3		0.236	0.242	1.00	0.147	pCi/Sample	05/30/14 15:45	06/03/14 16:48	1
Thorium-232	0.0258	U	4	0.0623	0.0623	1.00	0.131	pCi/Sample	05/30/14 15:45	06/03/14 16:48	1
Tracer	%Yield	Qua	lifier	Limits					Prepared	Analyzed	Dil Fac
Thorium-229	92.0			30 - 110					05/30/14 15:45	06/03/14 16:48	1

Method: A-01-R - Isot	opic Uraniu	ım (Alpha S	pectrometry)							
			Count	Total						
			Uncert.	Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0482	U	0.0643	0.0644	1.00	0.108	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Uranium-235/236	0.000	UC	0.0283	0.0283	1.00	0.0765	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Uranium-238	0.0561	u α	0.0481	0.0483	1.00	0.0614	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Tracer	% Yield	Qualifier	Limits					Prepared	Analyzed	DII Fac
Uranium-232	91.9		30 - 110					05/23/14 13:03	05/28/14 16:01	1

Client Sample ID: WAA-02-AF-PS-20140515

Date Collected: 05/15/14 16:23 Date Received: 05/19/14 14:08

Lab Sample ID: 160-6735-2

Matrix: Filter

Analyte	Result	Qualifier	Count Uncert. (20+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.248	3	0.173	0.174	1.00	0 248	pCi/Sample	05/23/14 14:06	06/17/14 11:31	1
Carrier	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	111	X	40 - 110					05/23/14 14 06	06/17/14 11 31	1
Method: A-01-R -	sotopic Thoriu	m (Alpha S	pectrometry)							
			Count	Total						
			Count Uncert.	Total Uncert						
Analyte	Result	Qualifler			RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Analyte Thorium-228			Uncert.	Uncert.	RL 100	MDC 0.295		Prepared 05/30/14 15 45	Analyzed 06/03/14 16.48	Dil Fac
Analyte Thorium-228 Thorium-230		UU	Uncert. (2σ+/-)	Uncert. (2σ+/-)			pCi/Sample			Dil Fac

HVE 24 June 2814

TestAmerica St. Louis

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Client Sample ID: WAA-02-AF-PS-20140515

Date Collected: 05/15/14 16:23

Date Received: 05/19/14 14:08

Lab Sample ID: 160-6735-2

Matrix: Filter

	%Yield	Qualifier	Limits					Prepared	Analyzed	DII F
Thorium-229	91.9		30 - 110					05/30/14 15:45	06/03/14 16:48	
/lethod: A-01-R - Isc	otopic Uraniu	ım (Alpha S	pectrometry)							
			Count	Total						
			Uncert.	Uncert.						
nalyte		Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC		Prepared	Analyzed	Dil F
Jranium-233/234	0.0564	U	0.0534	0.0536	1.00	0.0772	pCi/Sample	05/23/14 13:03	05/28/14 16:01	
Jranium-235/236	0.0601	ゴ	0.0491	0.0494	1.00	0.0301	pCi/Sample	05/23/14 13:03	05/28/14 16:01	
Jranium-238	0.0965	7	0.0682	0.0687	1.00	0 0889	pCi/Sample	05/23/14 13:03	05/28/14 16:01	
racer	% Yield	Qualifier	Limits					Prepared	Analyzed	Dil
Jranium-232	84.1		30 - 110					05/23/14 13:03	05/28/14 16:01	
lient Sample ID:	WAA-03-A	F-PS-201	40515	***********				Lab San	nple ID: 160-	6735
ate Collected: 05/15									-	ix: Filt
ate Received: 05/19/	/14 14:08						talit prome (nemplifitie e mer elevages-			
Method: 9315 - Radi	ium-226 (GFF	PC)								
			Count	Total						
			Uncert.	Uncert.						
Analyte	Result	Qualifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil
Radium-226	0.283	7	0.165	0.167	1.00	0.215	pCi/Sample	05/23/14 14:06	06/17/14 11:31	
										5"
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	DII
	%Yield 105	Qualifier	40 - 110					05/23/14 14:06	06/17/14 11:31	Dill
Ba Carrier	105		40 - 110 pectrometry) Count	Total						Dil
Ba Carrier Method: A-01-R - Iso	105 otopic Thoriu	ım (Alpha S	40 - 110 pectrometry) Count Uncert.	Total Uncert.				05/23/14 14:06	06/17/14 11:31	
Carrier Ba Carrier Method: A-01-R - Iso Analyte	105 otopic Thoriu Result	ım (Alpha S Qualifier	40 - 110 pectrometry) Count Uncert. (20+/-)	Total Uncert. (2σ+/-)	RL	MDC		05/23/14 14:06 Prepared	06/17/14 11:31 Analyzed	Dill
Ba Carrier Method: A-01-R - Iso Analyte Thorium-228	105 otopic Thoriu Result	Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790	Total Uncert. (2σ+/-) 0.0790	1.00	0.220	pCi/Sample	05/23/14 14:06 Prepared 05/30/14 15:45	06/17/14 11:31 Analyzed 06/03/14 16:48	
Ba Carrier Viethod: A-01-R - Iso Analyte Thorium-228 Thorium-230	105 otopic Thoriu Result -0.0299 0.314	Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193	Total Uncert. (2σ+/-) 0.0790 0.195	1.00	0.220 0.229	pCi/Sample pCi/Sample	O5/23/14 14:06 Prepared 05/30/14 15:45 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48	
Sa Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230	105 otopic Thoriu Result	Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790	Total Uncert. (2σ+/-) 0.0790	1.00	0.220	pCi/Sample pCi/Sample	05/23/14 14:06 Prepared 05/30/14 15:45	06/17/14 11:31 Analyzed 06/03/14 16:48	-
Ba Carrier Viethod: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232	105 otopic Thoriu Result -0.0299 0.314	Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193	Total Uncert. (2σ+/-) 0.0790 0.195	1.00	0.220 0.229	pCi/Sample pCi/Sample	O5/23/14 14:06 Prepared 05/30/14 15:45 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48	Dill
le Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232	705 Otopic Thoriu Result -0.0299 0.314 0.00272	Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193 0.0716	Total Uncert. (2σ+/-) 0.0790 0.195	1.00	0.220 0.229	pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48	Dil
Ra Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Tracer Thorium-229	705 Pesult -0.0299 0.314 0.00272 %Yield 85.6	Qualifier U U U U Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193 0.0716 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0790 0.195 0.0716	1.00	0.220 0.229	pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed	Dil
Ba Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Tracer Thorium-229	705 Pesult -0.0299 0.314 0.00272 %Yield 85.6	Qualifier U U U U Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193 0.0716 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0790 0.195 0.0716	1.00	0.220 0.229	pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed	Dil
Ba Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Tracer Thorium-229	705 Pesult -0.0299 0.314 0.00272 %Yield 85.6	Qualifier U U U U Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+l-) 0.0790 0.193 0.0716 Limits 30 - 110 Spectrometry)	Total Uncert. (2σ+l-) 0.0790 0.195 0.0716	1.00	0.220 0.229	pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed	
Ba Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Tracer Thorium-229 Method: A-01-R - Iso	Result -0.0299 0.314 0.00272 %Yleid 85.6	Qualifier U U U U Qualifier	40 - 110 pectrometry) Count Uncert. (20+l-) 0.0790 0.193 0.0716 Limits 30 - 110 Spectrometry) Count	Total Uncert. (2σ+l-) 0.0790 0.195 0.0716	1.00	0.220 0.229 0.180	pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed	Dil
Ra Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Tracer Thorium-229 Method: A-01-R - Iso Analyte	Result -0.0299 0.314 0.00272 %Yleid 85.6	Qualifier U U Qualifier U Qualifier	40 - 110 pectrometry) Count Uncert. (20+l-) 0.0790 0.193 0.0716 Limits 30 - 110 Spectrometry) Count Uncert.	Total Uncert. (2σ+l-) 0.0790 0.195 0.0716 Total Uncert.	1.00 1.00 1.00	0.220 0.229 0.180	pCi/Sample pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed 06/03/14 16:48	Dil
Ra Carrier Method: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Tracer Thorium-229 Method: A-01-R - Iso Analyte Uranium-233/234	ntopic Thoriu Result -0.0299 0.314 0.00272 %Yleid 85.6 otopic Uraniu	Qualifier U Qualifier Qualifier Im (Alpha S	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193 0.0716 Limits 30 - 110 Spectrometry) Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-) 0.0790 0.195 0.0716 Total Uncert. (2σ+/-)	1.00 1.00	0.220 0.229 0.180	pCi/Sample pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed 06/03/14 16:48	Dil
Ba Carrier Method: A-01-R - Iso Analyte	ntopic Thoriu Result -0.0299 0.314 0.00272 %Yield 85.6 cotopic Uraniu Result 0.249	Qualifier U Qualifier Qualifier Im (Alpha S	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193 0.0716 Limits 30 - 110 Spectrometry) Count Uncert. (2σ+/-) 0.0934	Total Uncert. (2σ+/-) 0.0790 0.195 0.0716 Total Uncert. (2σ+/-) 0.0957	1.00 1.00 1.00	0.220 0.229 0.180 MDC 0.0746 0.107	pCi/Sample pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared 05/30/14 15:45 Prepared 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed 06/03/14 16:48 Analyzed 05/28/14 16:01	Dill
Ra Carrier Wethod: A-01-R - Iso Analyte Thorium-228 Thorium-230 Thorium-232 Fracer Thorium-229 Wethod: A-01-R - Iso Analyte Uranium-233/234 Uranium-235/236	105 otopic Thoriu Result -0.0299 0.314 0.00272 %Yleld 85.6 otopic Uraniu Result 0.249 0.00968 0.280	Qualifier U Qualifier U Qualifier U Qualifier U Qualifier	40 - 110 pectrometry) Count Uncert. (2σ+/-) 0.0790 0.193 0.0716 Limits 30 - 110 Spectrometry) Count Uncert. (2σ+/-) 0.0934 0.0512	Total Uncert. (2σ+/-) 0.0790 0.195 0.0716 Total Uncert. (2σ+/-) 0.0957 0.0513	1.00 1.00 1.00	0.220 0.229 0.180 MDC 0.0746 0.107	pCi/Sample pCi/Sample pCi/Sample	Prepared 05/30/14 15:45 05/30/14 15:45 05/30/14 15:45 Prepared 05/30/14 15:45 Prepared 05/30/14 15:45	Analyzed 06/03/14 16:48 06/03/14 16:48 06/03/14 16:48 Analyzed 06/03/14 16:48 Analyzed 05/28/14 16:01 05/28/14 16:01	Dil I

HUE 24 Jun 14

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Lab Sample ID: 160-6735-4

Matrix: Filter

Client Sample ID: WAA-04-AF-PS-20140515

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte

Tracer

Thorium-228

Thorium-230

Thorium-232

Thorium-229

Result Qualifier

0.0757 U

%Yield Qualifler

3

-0 0367 U

0.296

89 5

Date Collected: 05/15/14 17:12

Date Received: 05/19/14 14:08

Method: 9315 - Radiu			Count	Total						
			Uncert.	Uncert.						
Analyte	Result	Qualifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fa
Radium-226	0.276	7	0.171	0.173	1.00	0 233	pCi/Sample	05/23/14 14 06	06/17/14 11 31	
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fa
Ba Carrier	109		40 - 110					05/23/14 14:06	06/17/14 11:31	
Method: A-01-R - Iso	topic Thoriu	m (Alpha S	pectrometry)							
	•		Count	Total						
			Uncert.	Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil F
Thorium-228	0.0746	UY	0.117	0.117	(1.00)	0.205	pCi/Sample	05/30/14 15:45	06/03/14 16 48	
Thorium-230	0.230	3	0.156	0.157	1.00	0.171	pCi/Sample	05/30/14 15:45	06/03/14 16:48	
Thorium-232	0.0578	u u	0.0780	0.0782	1.00	0.118	pCi/Sample	05/30/14 15:45	06/03/14 16:48	
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil F
Thorium-229	87.0		30 - 110					05/30/14 15:45	06/03/14 16:48	
Method: A-01-R - Iso	otopic Uraniu	ım (Alpha S	Spectrometry) Count	Total						
		m (Alpha S			RL	MDC	Unit	Prepared	Analyzed	Dil F
Analyte			Count Uncert.	Total Uncert.	RL 1.00	MDC 0.0873	Unit pCi/Sample	Prepared 05/23/14 13.03	Analyzed 05/28/14 16:01	Dilf
Analyte Uranium-233/234	Result	Qualifler 3	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)						Dill
Analyte Uranium-233/234 Uranium-235/236	Result 0.126	Qualifier	Count Uncert. (2σ+/-) 0.0741	Total Uncert. (2σ+/-) 0.0748	1.00	0.0873 0 0295	pCi/Sample	05/23/14 13.03	05/28/14 16:01	Dilf
Analyte Uranium-233/234 Uranium-235/236 Uranium-238	Result 0.126 0.0197	Qualifier 5 U Y U Y	Count Uncert. (2σ+/-) 0.0741 0.0278	Total Uncert. (2σ+/-) 0.0748 0.0278	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01	
Analyte Uranium-233/234 Uranium-235/236 Uranium-238	Result 0.126 0.0197 0.0315	Qualifler 5 U Y U Y	Count Uncert. (2σ+/-) 0.0741 0.0278 0.0498	Total Uncert. (2σ+/-) 0.0748 0.0278	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01	
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232	Result 0.126 0.0197 0.0315 % Yield 91.8	Qualifier U Y U C	Count Uncert. (2σ+/-) 0.0741 0.0278 0.0498 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0748 0.0278	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed	Dil F
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID:	Result 0.126 0.0197 0.0315 %Yield 91.8	Qualifier U Y U C	Count Uncert. (2σ+/-) 0.0741 0.0278 0.0498 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0748 0.0278	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01	DII F
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID: Date Collected: 05/15	Result 0.126 0.0197 0.0315 %Yield 91.8 WAA-05-A //14 15:17	Qualifier U Y U C	Count Uncert. (2σ+/-) 0.0741 0.0278 0.0498 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0748 0.0278	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01	DII F
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID: late Collected: 05/15/15/14/16/15/15/15/15/15/15/15/15/15/15/15/15/15/	Result 0.126 0.0197 0.0315 %Yield 91.8 WAA-05-A //14 15:17 //14 14:08	Qualifier U U Qualifier F-PS-201	Count Uncert. (20+1-) 0.0741 0.0278 0.0498 Limits 30 - 110	Total Uncert. (2σ+/-) 0.0748 0.0278 0.0499	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01	<i>ын</i>
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID: late Collected: 05/15/15/14/16/15/15/15/15/15/15/15/15/15/15/15/15/15/	Result 0.126 0.0197 0.0315 %Yield 91.8 WAA-05-A //14 15:17 //14 14:08	Qualifier U U Qualifier F-PS-201	Count Uncert. (20+1-) 0.0741 0.0278 0.0498 Limits 30 - 110 40515	Total Uncert. (2σ+/-) 0.0748 0.0278 0.0499	1.00	0.0873 0 0295	pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01	DII F
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID: late Collected: 05/15 late Received: 05/19/ Method: 9315 - Radi	Result 0.126 0.0197 0.0315 %Yield 91.8 WAA-05-A /14 15:17 /14 14:08 ium-226 (GFF	Qualifier U U Qualifier F-PS-201	Count Uncert. (20+/-) 0.0741 0.0278 0.0498 Limits 30 - 110 40515 Count Uncert.	Total Uncert. (2σ+/-) 0.0748 0.0278 0.0499 Total Uncert.	1.00	0.0873 0 0295 0.0872	pCi/Sample pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03 Lab San	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01 mple ID: 160- Matri	6735 ix: Fil
Analyte Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID: late Collected: 05/15/15/14/16/15/15/15/15/15/15/15/15/15/15/15/15/15/	Result 0.126 0.0197 0.0315 %Yield 91.8 WAA-05-A /14 15:17 /14 14:08 ium-226 (GFF	Qualifier U V Qualifier F-PS-201	Count Uncert. (20+1-) 0.0741 0.0278 0.0498 Limits 30 - 110 40515	Total Uncert. (2σ+/-) 0.0748 0.0278 0.0499	1.00	0.0873 0 0295	pCi/Sample pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01	6735 ix: Fil
Uranium-233/234 Uranium-235/236 Uranium-238 Tracer Uranium-232 Client Sample ID: Date Collected: 05/15 Date Received: 05/19/ Method: 9315 - Radio	Result 0.126 0.0197 0.0315 %Yield 91.8 WAA-05-A /14 15:17 /14 14:08 ium-226 (GFF	Qualifier U U Qualifier F-PS-201	Count Uncert. (20+/-) 0.0741 0.0278 0.0498 Limits 30 - 110 40515 Count Uncert. (20+/-)	Total Uncert. (2σ+/-) 0.0748 0.0278 0.0499 Total Uncert. (2σ+/-)	1.00 1 00 1.00	0.0873 0 0295 0.0872	pCi/Sample pCi/Sample pCi/Sample	05/23/14 13.03 05/23/14 13.03 05/23/14 13:03 Prepared 05/23/14 13.03 Lab San	05/28/14 16:01 05/28/14 16:01 05/28/14 16:01 Analyzed 05/28/14 16:01 mple ID: 160- Matri	Dil F

HUE 24 Jm14

MDC Unit

pCi/Sample

0.174 pCi/Sample

0.112 pCi/Sample

Prepared

05/30/14 15:45

05/30/14 15:45

05/30/14 15 45

Prepared

05/30/14 15 45

RL

1.00

1.00

(100)

TestAmerica St. Louis

Dil Fac

Dil Fac

Analyzed

06/03/14 16:48

06/03/14 16 48

06/03/14 16 48

Analyzed

06/03/14 16 48

Total

0.115

0.173

0.0852

Uncert. (20+/-)

Count

Uncert.

(20+/-)

0.115

0.172

0.0850

Limits

30 - 110

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Client Sample ID: WAA-05-AF-PS-20140515

Date Collected: 05/15/14 15:17 Date Received: 05/19/14 14:08 Lab Sample ID: 160-6735-5

Matrix: Filter

Method: A-01-R - Isoto	opio oraine	on (Alpina o	pectionieu y	,						
			Count	Total						
			Uncert.	Uncert.						
Analyte	Result	Qualifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.158	3	0.0928	0 0938	1.00	0.120	pCi/Sample	05/23/14 13:03	05/28/14 16 01	1
Uranium-235/236	0 0104	UY	0.0464	0.0464	1.00	0.0994	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Uranium-238	0.0749	υú	0.0644	0.0647	1.00	0.0920	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dii Fac
Uranium-232	82.6	T	30 - 110					05/23/14 13:03	05/28/14 16:01	1

Client Sample ID: WAA-00-AF-FB-20140515

Date Collected: 05/15/14 18:05

Date Received: 05/19/14 14:08

Lab Sample ID: 160-6735-6

Matrix: Filter

				Count	Total						
				Uncert.	Uncert.						
Analyte	Result	Qual	ifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fa
Radium-226	0.205	U	ч	0.167	0.168	1.00	0.254	pCi/Sample	05/23/14 14:06	06/17/14 11:29	
Carrier	%Yield	Qual	lifier	Limits					Prepared	Analyzed	DII Fa
Ba Carrier	113	X		40 - 110					05/23/14 14:06	06/17/14 11:29	-
Method: A-01-R - Is	otonic Thoriu	m /A	Inha S	naatramatar							
Metriou. A-01-11 - 13	otopic mond	···· (A	upna c	Count	Total						
				Uncert.	Uncert.						
Analyte	Result	Qual	ifier	(2σ+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fa
Thorium-228	-0.000875	Ū	U	0.0881	0.0881	(1.00)	0.211	pCi/Sample	05/30/14 15:45	06/03/14 16 48	- United
Thorium-230	0.503	J		0.215	0.219	1.00	0.139	pCi/Sample	05/30/14 15:45	06/03/14 16:48	
Thorium-232	0.0109	-	4	0.0698	0.0698	(.00)	0.168	pCi/Sample	05/30/14 15:45	06/03/14 16:48	,
Tracer	% Yield	Qual	lifier	Limits					Prepared	Analyzed	Dil Fa
Thorium-229	86.3			30 - 110					05/30/14 15:45	06/03/14 16 48	
Method: A-01-R - Is	otonio Uraniu	/A	Inha C		ć						
Metilou. A-01-11 - 15	otopic Graind	, , , , , , , , , , , , , , , , , , ,	upna s	Count	Total						
				Uncert.	Uncert.						
Analyte	Result	Qual	ifier	(20+/-)	(20+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.0488	Ū	V	0.0728	0.0729	(1.00)	0.125	pCi/Sample	05/23/14 13:03	05/28/14 16:01	
Uranium-235/236	0.0405	ュ		0.0405	0.0406	1 00	0.0304	pCi/Sample	05/23/14 13:03	05/28/14 16:01	,
Uranium-238	0.0893	כ		0.0539	0 0544	1 00	0.0244	pCi/Sample	05/23/14 13:03	05/28/14 16 01	,
Tracer	% Yield	Qual	ifier	Limits					Prepared	Analyzed	Dil Fac

4 Je 14

QC Sample Results

Total

Client: Tetra Tech EM Inc.

Analysis Batch: 127235

Matrix: Filter

Analyte

Carrier

Ba Carrier

Matrix: Filter

Analysis Batch: 127235

Radium-226

Project/Site: West Lake Landfill - Filters

Lab Sample ID: MB 160-123713/1-A

Lab Sample ID: LCS 160-123713/2-A

Method: 9315 - Radium-226 (GFPC)

TestAmerica Job ID: 160-6735-1

Dil Fac

RER

Limit

Dil Fac

1

1

1

0.04

Client Sample ID: Method Blank

Prep Type: Total/NA Prep Batch: 124653

06/03/14 23:25

Client Sample ID: Method Blank

Prep Type: Total/NA Prep Batch: 123713

Count Uncert. мв мв Uncert. Analyzed Dil Fac (20+/-) RL MDC Unit Prepared Result Qualifier $(2\sigma + / -)$ 05/23/14 14:06 pCi/Sample 06/17/14 11:30 1.00 0.267 0.173 0.174 0.1994 U

RL

1.00

MDC Unit

pCi/Sample

0.141 pCi/Sample

0.141

RL

1.00

1.00

1.00

MDC Unit

0.242 pCi/Samp

MB MB Limits %Vield Qualifier 102 40 - 110

Analyzed

06/17/14 11:30

Client Sample ID: Lab Control Sample Prep Type: Total/NA

Client Sample ID: Lab Control Sample Dup

%Rec

95

%Rec.

Limits

65 - 140

Prepared

05/23/14 14:06

Prep Batch: 123713

Prep Type: Total/NA

Prep Batch: 123713

RER

Total %Rec. LCS LCS Uncert. Spike RL MDC Unit %Rec Limits (20+/-) Result Qual Analyte Added pCi/Samp 94 65 - 140 4.13 1.00 0.317 Radium-226 45.0 42.32

LCS LCS Carrier **%Yield Qualifier** Limits Ba Carrier 113 X 40 - 110

Lab Sample ID: LCSD 160-123713/3-A

Matrix: Filter Analysis Batch: 127235

Carrier

Ba Carrier

Thorium-228

Thorium-229

Total LCSD LCSD Uncert. Spike

Added Result Qual $(2\sigma + / -)$ Analyte 45.0 42.63 4.15 Radium-226

LCSD LCSD Limits %Yield Qualifier 40 - 110 110

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-124653/1-A

Matrix: Filter Analysis Batch: 125049

Total Count MB MB Uncert. Uncert. $(2\sigma + / -)$ $(2\sigma + / -)$ Result Qualifier Analyte

U

0.0502

0.432

30 - 110

0.0502

0.466

0.0902

Thorium-230 2.077 Thorium-232 0.08008 U 0.0899 MB MB %Yield Qualifier Limits Tracer

87.7

0.005547

0.118 pCi/Sample 05/30/14 15:45

Prepared

Prepared

05/30/14 15:45

05/30/14 15:45

Dil Fac Analyzed 05/30/14 15:45 06/03/14 23:25

Analyzed

06/03/14 23:25

06/03/14 23:25

TestAmerica St. Louis

QC Sample Results

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-124653/2-A Matrix: Filter

Analysis Batch: 125073

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 124653

Total %Rec. Spike LCS LCS Uncert. Added Result Qual $(2\sigma + / -)$ RL MDC Unit %Rec Limits Analyte 1.00 0.396 pCi/Samr 105 81 - 118 Thorium-230 17.3 18.22 2.29

LCS LCS

Tracer **%Yield Qualifier** Thorium-229 48.7

Limits 30 - 110

Client Sample ID: Lab Control Sample Dup

%Rec.

Prep Type: Total/NA

Prep Batch: 124653

Lab Sample ID: LCSD 160-124653/3-A

Matrix: Filter

Analysis Batch: 125074

Total Spike LCSD LCSD Uncert. Added Result Qual $(2\sigma + / -)$ 17.3 17.52

1.89

RL

1.00

MDC Unit 0.177 pCi/Samp

%Rec Limits 101 81 - 118

RER 0.17

RER

Limit

LCSD LCSD

Tracer Thorium-229

Thorium-230

Analyte

%Yield Qualifier 94.5

Limits 30 - 110

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-123705/1-A

Lab Sample ID: LCS 160-123705/2-A

Matrix: Filter

Matrix: Filter

Uranium-233/23 Uranium-238

Analyte

Analysis Batch: 124329

Client Sample ID: Method Blank

Prep Type: Total/NA Prep Batch: 123705

			Count	Total						
	MB	MB	Uncert.	Uncert.						
Analyte	Result	Qualifier	(2σ+/-)	(2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.2455		0.0921	0.0944	1.00	0.0735	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Uranium-235/236	0.009548	U	0.0191	0.0191	1.00	0.0286	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1
Uranium-238	0.2527		0.0906	0.0931	1.00	0.0586	pCi/Sample	05/23/14 13:03	05/28/14 16:01	1

MR MR

Tracer %Yield Qualifier Limits Uranium-232 30 - 110 93.1

Prepared Analyzed 05/23/14 13:03 05/28/14 16:01

102

Client Sample ID: Lab Control Sample

82 - 122

Prep Type: Total/NA Prep Batch: 123705

Analysis Batch: 124330 Spike LCS LCS

Added

25.5

26.0

Result Qual

24.92

26.51

Total

2.41

1.00

Uncert. %Rec. MDC Unit RL Limits $(2\sigma + / -)$ %Rec 0.0959 pCi/Samp 98 84 - 120 2.27 1.00

0.0957 pCi/Samp

LCS LCS

%Yield Qualifier Limits Tracer Uranium-232 91.2 30 - 110

TestAmerica St. Louis

6/19/2014





Dil Fac

QC Sample Results

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

1/2

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Limits

30 - 110

Lab Sample ID: LCSD 160-123705/3-A

%Yield Qualifier

89.7

Matrix: Filter

Tracer

Uranium-232

Analysis Batch: 124331

Client	Sample	ID:	Lab	Control	Sample	Dup
--------	--------	-----	-----	---------	--------	-----

Prep Type: Total/NA

Prep Batch: 123705

•				Total							
	Spike	LCSD	LCSD	Uncert.					%Rec.		RER
Analyte	Added	Result	Qual	(2σ+/-)	RL	MDC	Unit	%Rec	Limits	RER	Limit
Uranium-233/23	25.5	24.08		2.20	1.00	0.0881	pCi/Samp	95	84 - 120	0.19	1
4 Uranium-238	26.0	25.44		2.32	1.00	0.0238	pCi/Samp	98	82 - 122	0.23	1
LCSD LCSD											

9

QC Association Summary

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

R	a	ıd

Prep Batch: 123705

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6735-1	WAA-01-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-2	WAA-02-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-3	WAA-03-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-4	WAA-04-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-5	WAA-05-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-6	WAA-00-AF-FB-20140515	Total/NA	Filter	ExtChrom	
LCS 160-123705/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-123705/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-123705/1-A	Method Blank	Total/NA	Filter	ExtChrom	

Prep Batch: 123713

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6735-1	WAA-01-AF-PS-20140515	Total/NA	Filter	DPS-21	
160-6735-2	WAA-02-AF-PS-20140515	Total/NA	Filter	DPS-21	
160-6735-3	WAA-03-AF-PS-20140515	Total/NA	Filter	DPS-21	
160-6735-4	WAA-04-AF-PS-20140515	Total/NA	Filter	DPS-21	
160-6735-5	WAA-05-AF-PS-20140515	Total/NA	Filter	DPS-21	
160-6735-6	WAA-00-AF-FB-20140515	Total/NA	Filter	DPS-21	
LCS 160-123713/2-A	Lab Control Sample	Total/NA	Filter	DPS-21	
LCSD 160-123713/3-A	Lab Control Sample Dup	Total/NA	Filter	DPS-21	
MR 160-123713/1-A	Method Blank	Total/NA	Filter	DPS-21	

Prep Batch: 124653

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-6735-1	WAA-01-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-2	WAA-02-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-3	WAA-03-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-4	WAA-04-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-5	WAA-05-AF-PS-20140515	Total/NA	Filter	ExtChrom	
160-6735-6	WAA-00-AF-FB-20140515	Total/NA	Filter	ExtChrom	
LCS 160-124653/2-A	Lab Control Sample	Total/NA	Filter	ExtChrom	
LCSD 160-124653/3-A	Lab Control Sample Dup	Total/NA	Filter	ExtChrom	
MB 160-124653/1-A	Method Blank	Total/NA	Filter	ExtChrom	

Tracer/Carrier Summary

Client: Tetra Tech EM Inc.

Project/Site: West Lake Landfill - Filters

TestAmerica Job ID: 160-6735-1

Method: 9315 - Radium-226 (GFPC)

Matrix: Filter

Prep Type: Total/NA

			Percent Yield (Acceptance Limits)
		Ва	
Lab Sample ID	Client Sample ID	(40-110)	
160-6735-1	WAA-01-AF-PS-20140515	112 X	
160-6735-2	WAA-02-AF-PS-20140515	111 X	
160-6735-3	WAA-03-AF-PS-20140515	105	
160-6735-4	WAA-04-AF-PS-20140515	109	
160-6735-5	WAA-05-AF-PS-20140515	119 X	
160-6735-6	WAA-00-AF-FB-20140515	113 X	
LCS 160-123713/2-A	Lab Control Sample	113 X	
LCSD 160-123713/3-A	Lab Control Sample Dup	110	
MB 160-123713/1-A	Method Blank	102	
Tracer/Carrier Legend			
Ba = Ba Carrier			

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Filter

Prep Type: Total/NA

			Percent Yield (Acceptance Limits)
		Th-229	
Lab Sample ID	Client Sample ID	(30-110)	
160-6735-1	WAA-01-AF-PS-20140515	92.0	
160-6735-2	WAA-02-AF-PS-20140515	91.9	
160-6735-3	WAA-03-AF-PS-20140515	85.6	
160-6735-4	WAA-04-AF-PS-20140515	87.0	
160-6735-5	WAA-05-AF-PS-20140515	89.5	
160-6735-6	WAA-00-AF-FB-20140515	86.3	
CS 160-124653/2-A	Lab Control Sample	48.7	
CSD 160-124653/3-A	Lab Control Sample Dup	94.5	
MB 160-124653/1-A	Method Blank	87.7	
Tracer/Carrier Legend			

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Filter Prep Type: Total/NA

			Percent Yield (Acceptance Limits)
		U-232	
ab Sample ID	Client Sample ID	(30-110)	
60-6735-1	WAA-01-AF-PS-20140515	91.9	
160-6735-2	WAA-02-AF-PS-20140515	84.1	
160-6735-3	WAA-03-AF-PS-20140515	89.1	
160-6735-4	WAA-04-AF-PS-20140515	91.8	
160-6735-5	WAA-05-AF-PS-20140515	82.6	
160-6735-6	WAA-00-AF-FB-20140515	87.3	
CS 160-123705/2-A	Lab Control Sample	91.2	
LCSD 160-123705/3-A	Lab Control Sample Dup	89.7	
MB 160-123705/1-A	Method Blank	93.1	
Tracer/Carrier Legend			
U-232 = Uranium-232			

TestAmerica St. Louis